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ABSTRACT

This document provides an overview of the 17 universities in the Province of Ontario, describing undergraduate and graduate program offerings, sources of operating income and research funding, and linkages between the universities and the private sector. The first section includes a discussion of the appraisal process used to assess both graduate and undergraduate academic programs. The second section, on research assessment, explains the self-regulated monitoring process that governs the accountability relationship between the universities and the provincial government. Sub-sections consider: assessment of individual researchers, assessment of research through the three federal granting councils, performance indicators for research, a research funding infrastructure envelope, the Ontario Centres of Excellent Program, the Ontario Research and Development Challenge Fund, and the Canada Foundation for Innovation. The final section discusses technology transfers in sub-sections on: industry pull, technology push, resources required for effective technology transfer, and institutional research performance indicators. (CH)

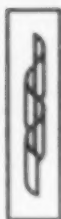
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ONTARIO UNIVERSITIES

- ACADEMIC ASSESSMENT
- ASSESSMENT OF RESEARCH
- TECHNOLOGY TRANSFER

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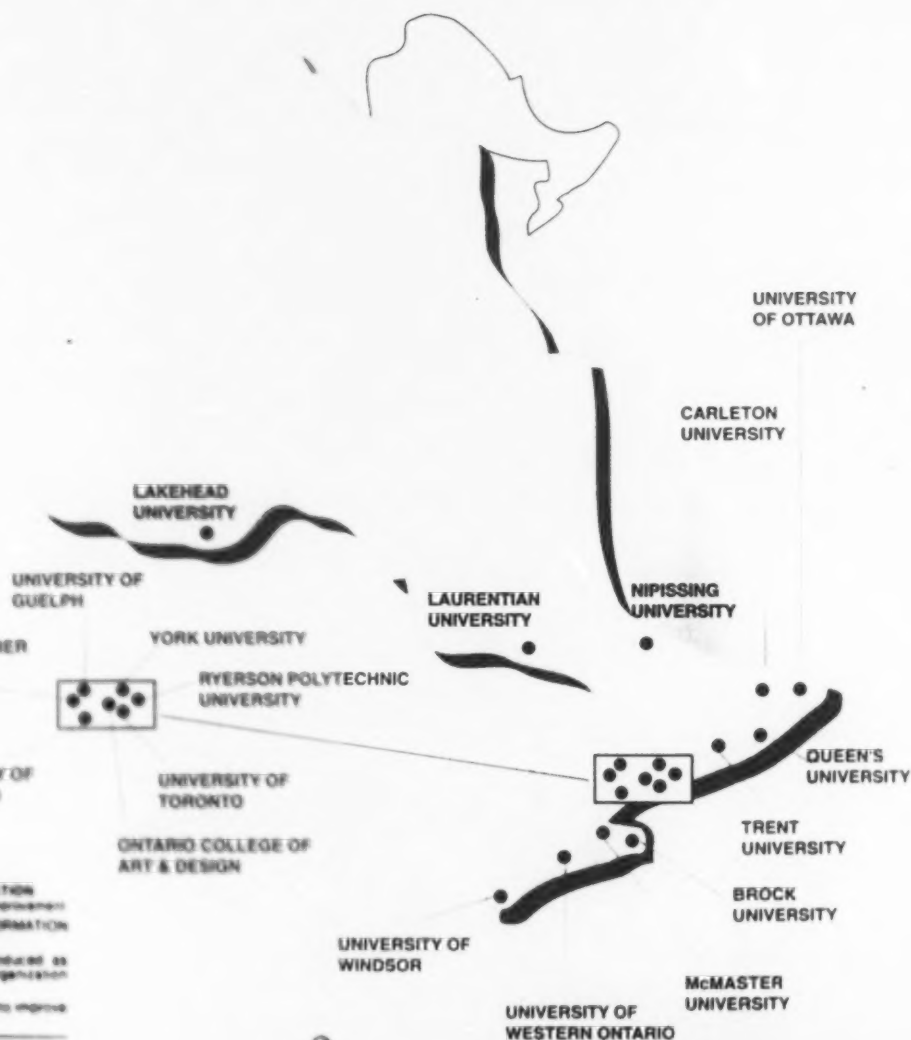
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ONTARIO UNIVERSITIES

- ACADEMIC ASSESSMENT
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-

Compiled for the
Fourth Meeting of Rectors and Presidents of Universities
of the Four Motors for Europe, Wales and Ontario,
plus a delegation from Québec

Barcelona, Spain June 4-6, 1997

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OVERVIEW

Ontario is the heartland of knowledge acquisition and dissemination in Canada. The province has the greatest concentration of postsecondary teaching, learning and research resources with approximately 40% of all of the country's activities occurring in this province.

Ontario's 17 universities provide a vibrant research environment to ensure that quality and innovation remain as cornerstones of our activities. Indeed, it is just such innovation that will determine our country's future position in the world economy. The Province of Ontario is an engine of growth and prosperity for the country not only economically but also socially and culturally. Sustainable prosperity in all its dimensions, however, will depend on our continued ability to pursue research in sciences and technology, as well as in the humanities and social sciences.

Ontario's universities offer first- and second-entry undergraduate programs as well as graduate-level programs. Combined, they offer programs in more than 150 disciplines to 305,683 enrolled students, and employ 12,400 full-time faculty and the full-time equivalent of 2,000 part-time faculty and 17,500 non-academic staff.

Two-thirds of our total operating income of (CDN) \$2,810 million (1995-96) came from provincial government grants, tuition fees accounted for 26.5%, and the remaining income came from other fees and sources of income.

Governments are major providers of research funding. The Federal Government of Canada provides funding to federal granting councils that, in turn, provide funding to peer-reviewed research projects. The Government of Ontario provides funding to universities for operations, capital needs, special projects, as well as research overhead and infrastructure. Research at Ontario universities is also funded through a variety of other means. Private-sector partnerships are pursued to secure contract research as well as to initiate collaborative projects for the benefit of the industry partner and the faculty involved.

The importance of enhancing linkages between universities and the private sector is evidenced by the introduction in 1997 of two initiatives to lever more private-sector funds in research and development at universities in this country.

In its 1997 budget, the federal government announced the creation of the Canada Foundation for Innovation (CFI). The CFI is an independent, not-for-profit corporation with the objectives of supporting economic growth and job creation, increasing Canada's capability to carry out world-class scientific research and technology, and promoting productive networks and collaboration among universities, research hospitals and the private sector. The CFI will provide funding of approximately \$180 million per year over the next five years and requires participants to attract non-governmental funds to qualify for funding.

In its May 6, 1997 budget, the Ontario government announced the creation of a Research and Development Challenge Fund. The fund will provide \$50 million per year over the next 10 years to help universities lever funds for research and development from the private sector, federal granting councils and other partners. Again to qualify, one third of project costs must be raised from the private sector.

ONTARIO UNIVERSITIES

ASSESSMENT OF ACADEMIC PROGRAMS

("Collaboration Among Universities in Program Quality Assurance: A Case Study of Ontario Universities," by Nicole Bégin-Heick, Executive Director, Ontario Council on Graduate Studies, 444 Yonge Street, Toronto, Canada M5B 2H4)

The cornerstone of academic assessment at the graduate level in Ontario universities is the program review and appraisal process, which has been in effect since 1967. Unique in North America, the operation is governed and financed by the universities under the aegis of the Council of Ontario Universities (COU), a voluntary organization created to promote cooperation among the universities. The appraisal process is administered by the Ontario Council on Graduate Studies (OCGS), an affiliate of COU, which is composed of the Deans of Graduate Studies (or equivalent officers) from Ontario universities. OCGS appoints an Interdisciplinary Appraisals Committee that is the body charged with carrying out the appraisals; it receives and votes on the recommendations of the committee, and informs the Ministry of Education and Training (MET) and COU of the results of its appraisals.

Appraisal Process

There are two types of appraisals procedures. The first is directed toward the evaluation of the quality of new program proposals and is referred to as standard appraisal (Stewart, 1989). The second, established in 1982 and referred to as periodic appraisal, involves the evaluation of the quality of existing programs, by discipline, on a seven-year cycle (Filteau, 1991). Assessment by peers is of central importance to the evaluation of graduate programs in the appraisal process. External consultants employed by OCGS are peers in the discipline of the program being reviewed. Members of the Interdisciplinary Appraisals Committee are academic peers. Peers are selected and charged according to generally accepted guidelines (Frazier, 1995). External consultants are:

- experts in the disciplines but also have experience in the management of graduate programs and the supervision of students
- selected from a list proposed by the unit under evaluation or with its consent
- at "arm's-length" from the institution being reviewed
- expected to conduct their review according to standard guidelines

Members of the Interdisciplinary Appraisals Committee are:

- expected to be experts in their respective discipline and have experience in supervision
- selected from nominations made by the universities
- obliged to declare any conflict of interest
- expected to act according to the good of the collectivity and not as advocates for their own institution

The appraisals process is voluntary in that it exists because, collectively, the university presidents have agreed from the outset to offer only programs that are classified as being of "Good Quality" as a result of the periodic appraisal or that have been "Approved to Commence" as a result of a standard appraisal. It was established initially in response to government concerns about the exponential growth of graduate programs. At that time, the university funding formula was based on weighted student enrolment (Monahan, 1988) wherein graduate students are weighted more heavily than undergraduate students. As a consequence, the provincial government was placing pressure on the universities to be accountable for the development of new graduate programs (Watt, 1986). Such pressures continue today, despite numerous changes to the funding mechanism, which over the years has become an allocative formula, although the differential weights for graduate and undergraduate studies still exist notionally. The OCGS appraisals process continues to serve the universities well: it is highly respected by the provincial government and it is becoming known internationally. It has become embedded in the university funding mechanism in that only students enrolled in OCGS-approved programs may be counted for funding.

Until 1996, the Ontario Council on University Affairs (OCUA) and its Academic Advisory Committee (AAC) acted as a "buffer body" between COU (and therefore OCGS and its Appraisals Committee) and the MET. In addition, the AAC was specifically charged with monitoring the appraisals process. In 1985, OCUA and its AAC established an external three-person Review Commission to examine the appraisal process. The commission was asked to evaluate the integrity and credibility of the appraisal process. After spending several months reviewing the procedures, information and conduct of the process, including attending meetings of the Appraisals Committee, the commission submitted its final report (Dupré, 1986). It concluded that the process "... produces reliable and credible judgements of the academic quality of existing and proposed graduate programs in Ontario." (Currently, the universities through COU and the MET are attempting to devise a new relationship in view of the demise of OCUA and its AAC in the summer of 1996.)

During the period from 1982 to the present, 27 programs have been closed as a result of the appraisals process. This category includes programs that were terminated as a result of the recommendation of the Appraisals Committee, as well as programs that the universities did not submit for periodic appraisal and, therefore, in which they ceased to enrol new students, based on the realization that the quality would not meet appraisal standards. Furthermore, approximately 20 programs were consolidated as a result of inter- or intra-institutional collaboration. These facts illustrate that the OCGS appraisals system is a powerful means of effecting change through a collective process. It should be emphasized, however, that the appraisals process is predicated primarily on the basis of improvement of program quality and not on the basis of program rationalization. The best evidence that the appraisals process does not stifle developments is that, during the same period, almost 100 new programs were approved to begin, including new master programs, expansion of master's programs to doctoral programs and creation of new doctoral programs.

Review of Graduate Programs - Key Features

During this same period (1982-96), the appraisals process has been a focus for improving several aspects of graduate education in Ontario universities. For example, through collective action, major gains have been made in achieving more timely and better rates of completion of doctoral programs (OCGS, 1991, 1992) and more attention is being devoted to issues of educational equity (OCGS, 1993). Collectively, the Deans of Graduate Studies have addressed issues such as the special educational needs of part-time students, internationalization (OCGS, forthcoming), the quality of the graduate experience, etc. The financial support of students is a continuing preoccupation.

The most important feature of OCGS and its appraisals process is probably that the rules and procedures are established in a cooperative manner by the universities. These rules and procedures are published and provided freely to any interested person or organization. OCGS is governed by a set of statutes and a by-law, established in 1967 and revised on a number of occasions since; revisions are usually initiated by OCGS, but all substantive changes must be approved by COU. The regulations governing the appraisal process are established in the same way. Although new regulations or changes are invariably initiated by OCGS, substantive changes must be approved by COU and are *de facto* transmitted to each university. An important feature of these regulations is that, although the Appraisals Committee must report its recommendations to OCGS, OCGS cannot debate the substance of the report. Its role is to ensure that the procedures have been properly followed. Similarly, the annual report is provided to COU for information.

The process is dynamic and evolves to meet current needs. As designed in the late '60s, the process was an ideal mechanism for assessing the research expertise of the faculty and the structure of programs, which are at the heart of graduate education. These factors alone, however, do not ensure high-quality programs. Recently, there has been a need to refocus, to pay more attention to the clients, the graduate students and their educational experience, without neglecting the quality of the faculty (OCGS, 1996). This priority has prompted a review of the appraisals procedures. The substance of the appraisal will not change; however, there will be a greater focus on graduate students and a need to document experience and outcomes. As well, we are striving to ensure that graduate departments/programs are better informed about the objectives of the appraisal and the tool that it affords them for the constant and continued improvement of their programs (cf. Herbeson, 1994). In other words, the need for academic units to produce the appraisals documents should be viewed as an opportunity for reflection and action, rather than as a necessary evil or an intrusion.

The key features relating to the review of graduate programs in Ontario are that the process (Yeates, 1990):

- Has evolved over more than three decades to serve the needs of the university community in Ontario.
- Has developed in the context of university-provincial government discussions over the financing and development of graduate studies and research.
- Relates not to a single university but to all existing and proposed new programs in Ontario's 17 autonomous universities.
- Is governed by a set of by-laws and procedures that must be approved formally by COU and transmitted to the senate or governing council of each university.
- Is financed by the universities and managed by the Deans of Graduate Studies through OCGS and its secretariat.
- Has as its major goals: the assurance of quality; improvements in graduate programs (Webster, 1990); public accountability regarding the standards of graduate work; the preservation of program autonomy; the promotion of good practice in program management; and, consistent with quality, provision of access to a wide array of graduate programs within the province.

These features are responsible for the success of the process in maintaining and enhancing the quality of graduate education in Ontario. Furthermore, the credibility earned by the appraisals process since its inception has encouraged the Government of Ontario to look to the universities to establish collectively an audit mechanism for the quality assurance of undergraduate programs that is currently being implemented by COU.

Undergraduate Program Review

Ontario universities have been developing an assurance process for undergraduate programs. The Undergraduate Program Review Audit Committee (UPRAC), governed and financed by the universities and audit program, will be administered by the Ontario Council of Academic Vice-Presidents (OCAV), which is composed of the Vice-Presidents (Academic) of the 17 universities.

- The committee will audit each university's undergraduate program evaluation process on a seven-year cycle by studying a sample of the evaluations; advise universities on needed improvements to their procedures; review universities' follow-up reports; and report the committee's findings to the universities, the Council of Ontario Universities and the Ministry of Education and Training.
- The audit process will focus on quality assurance and will require each university to conduct an evaluation of its own undergraduate programs that involves self-study and internal peer-review assessments as well as external review assessments.
- The first cycle of undergraduate program audits begin in spring of 1997.

References

- Dupré, S. (1986) Report to the Ontario Council on University Affairs: an assessment of the appraisal process. Toronto: Ontario Council on University Affairs, AM 86: III.
- Filteau, C. (1993) *Evaluating the evaluators: an analysis of the OCGS programme appraisal process*. Proceedings of the Fifth International Conference on Assessing Quality in Higher Education. Bonn. pp. 37-54
- Frazier, M. J. (1995) *Issues of quality*. Higher Education in Europe 20:13-17
- Herbeson, E. (1994) *The Ontario Council on Graduate Studies appraisal process*. Proceedings of the Annual Conference of the Canadian Society for the Study of Higher Education. Calgary. pp. 64-65

- Monahan, E.J. (1988) *The allocation of financial support by formula: the experience of Ontario* Minerva 26, 3, 370 - 391.
- OCGS (1991) *Doctoral graduation rates in Ontario universities*: discussion paper.
- OCGS (1992) *Graduation rates and times-to-completion*: colloquium proceedings.
- OCGS (1993) *OCGS appraisals 1982-83 to 1992-93: programme "restructuring" at the graduate level*.
- OCGS (1996) *Appraising inward/outward and onward: our best sense of what's ahead*: proceedings.
- OCGS (forthcoming) *Internationalizing our graduate schools*: proceedings.
- Stewart, H.B. (1988) *The development of graduates in Ontario between 1960 and 1985*. Toronto: Council of Ontario Universities.
- Watt, L.A.K. (1986) *Graduate studies in Ontario: the role of government*. Conference on Government and Higher Education. OISE, October 23-24, 1986.
- Webster, W.G. (1990) *Quality assurance: a framework for Canadian universities* The Canadian Journal of Higher Education 20, 1, 75-85.
- Yeates, M. (1990) *The appraisals process in Ontario*. OCGS publication (revised 1996).

ASSESSMENT OF RESEARCH

(Edited from materials compiled by the Ministry of Education and Training, Government of Ontario, Queen's Park, Toronto, Canada)

As autonomous institutions, Ontario's universities essentially manage their own academic affairs -- including all aspects of program and curriculum development, delivery and assessment, and the conduct and assessment of research programs -- without the direct involvement of government. The provincial government, through the Ministry of Education and Training, provides \$1.5 billion in operating grants in support of the teaching, research and service functions of the universities, and has broad expectations regarding accountability for funds provided and specific expectations regarding accountability mechanisms for some funding programs. With respect to teaching and research programs, the government is interested in mechanisms that give assurance that the assessment processes in place within the institutions are objective and rigorous, and that it include adequate provisions for maintaining and improving quality.

The accountability relationship between the universities and the Ontario government can be described as one of "monitored self-regulation." This structure was reinforced by the Ontario Task Force on University Accountability, which reported its findings in 1993.

Assessment of Individual Researchers

In most universities in Ontario, the research performance of individual faculty members is an essential component of the periodic assessment of their overall performance, and is an important consideration in the awarding of tenure and promotions, as well as the determination of progress through the ranks. In those universities where collective agreements with faculty exist, the manner in which research performance will be evaluated is outlined in the agreements. While there is some variation in practice among the universities with respect to research performance, for the purposes of this paper it is sufficient to note that these agreements usually stipulate that faculty have the right and responsibility to devote a reasonable portion of their time to meaningful scholarship and research activities, and that the university, insofar as it is possible, will attempt to provide adequate facilities for this purpose.

The manner of collecting data on, and evaluating research performance of, individual faculty members varies but, generally, it can be expected that information similar to that gathered on faculty for the OCGS program appraisal process would be appropriate for the periodic review of faculty performance. Such a process would factor in the considerations related to the granting of tenure and promotions, assessing performance for determination of salary increments, etc.

Queen's University, for example, requires that each faculty member submit an annual report to the

Dean. Reports are to include information on teaching assignments, graduate student supervision, and scholarly, creative and artistic work. In the latter category, faculty members in arts and science outline the following in reporting their activity in the previous calendar year:

- publications, books, papers in publications with a review process, review articles, chapters in books, etc.
- financial support including grants from federal or provincial agencies, other grants and contracts
- supervision of postdoctoral students, research assistants and technicians
- titles of current research programs
- conferences and workshops attended
- papers or other presentations delivered at conferences, workshops, etc.
- seminars presented
- memberships in professional societies

Another major category of review relates to professional service work including offices held in professional societies, work as an editor or member of an editorial board, refereeing of manuscripts, review of grant applications, and outside and inside consultancy, i.e., program reviews, promotion and tenure reviews.

Other categories included in these reports are honours or awards received, consulting and contract research conducted, and patents and licences obtained. In instances where a researcher's work cannot be easily evaluated using these reports, as when much of the work is conducted off-site to supplement the internal evaluation process, input would be solicited from granting agencies, peers and colleagues.

It is worth noting that, as another assurance of quality, information gathered on the faculty member's publications places emphasis on papers in publications selected through a peer-review process. The OCGS program appraisal process also assesses faculty publications in refereed journals.

With increasing emphasis on research performance, many universities have special incentives to recognize outstanding scholarly contributions. Carleton University, for example, recently established a program of "Research Achievement Awards," which comprises 10 awards per year, each valued at \$10,000. The awards are intended to enhance the research productivity of the recipients. At the option of the recipient, the awards take the form of teaching release time, equipment, research assistants or other appropriate research expenses. Candidates, either

self-selected or nominated, provide information on research conducted over the past five years; research proposed for the term of the award; and publications, grants reviewed and contracts held over the past years; and other pertinent information. Other universities have similar programs.

Assessment of Research Through the Three Federal Granting Councils

The OCGS process, through which all graduate programs are reviewed on a seven-year cycle, represents the most comprehensive review of research in the universities because all faculty and graduate-student research activities are scrutinized in the process.

Another major peer-review process is involved in the awarding of research grants through the three national granting councils funded by the Government of Canada: the Natural Sciences and Engineering Research Council (NSERC); the Medical Research Council (MRC); and the Social Sciences and Humanities Research Council (SSHRC). These councils support university-based research and research training, with grants directed mainly toward individual researchers of research teams. Grants from these three councils are a major source of sponsored research revenue for Ontario's universities, providing over \$230 million in 1994-95 and representing 35% of all sponsored research revenue that year.

Given the rigours and credibility of the peer-review process, success in these national granting council competitions is generally viewed as an indicator of research excellence in Canada and as a valid indicator of performance at the individual, program and institutional level.

The peer-review processes and criteria for each type of a wide array of grant programs administered by each of the three councils are specific to each program, but include some common features:

- Researchers complete detailed application forms providing information on the proposed course of work, theoretical underpinnings, methodology, references to previous work and anticipated results; training, qualifications and publications of the researcher or research team; an itemized budget for the project or program (only direct costs such as equipment, supplies and student stipends are eligible for support; the researcher's salary is not eligible); other funding previously received or currently held by the researcher or team; and the contribution from partners outside the university sector if the program requires partners and, for very large projects, a description of the management team.
- The application is typically reviewed by three to five international experts in the field; experts from all sectors, within and beyond Canada may be consulted.

- The application and all reviews are submitted to an expert committee that evaluates each application in the context of all applications received in that field. The committee evaluates the application against program criteria, which include the quality of the proposed work and the qualifications and track record of the applicant(s). Additional program criteria usually exist for partnership programs.
- The expert committee recommends whether or not the application should be funded, and the size and duration of grant.
- The committee is also responsible for choosing the peer reviewers for applications (often based on suggestions by the applicants).
- The members of the council itself establish programs and policies and determine the expert committee structures, memberships, policies and procedures. Ultimate funding approval rests with each council.

NSERC is developing a performance indicator system to assess its programs. For each of its three main business lines, the following are identified: main goals, outcomes, and indicators to track progress toward outcomes. NSERC differentiates between two types of performance measures for university research: output measures and outcome measures. "Outputs" are the immediate results of the research: published papers, citations of those papers, patents, product and process innovations, trained people, etc. "Outcomes" are the longer-term results: new insights into natural processes; increased productivity; new or revitalized industries; improved social, regulatory and economic policy-making; and social and economic advances in general.

Performance Indicators for Research

In 1993, at the request of the Ontario Task Force on University Accountability, the COU Committee on Accountability, Performance Indicators and Outcomes Assessment began initial work on the development of a set of performance indicators "that might be used by the individual governing bodies of the Ontario universities to improve their ability to hold their institutions accountable." The Task Force report noted that it was interested in "a comparatively small number of management or performance indicators that were reliable, easily understandable and meaningful, to assist in the assessment of an institution's progress in reaching its stated objectives." Furthermore, the indicators were meant to be used "in conjunction with institutional mission statements and their supporting academic and financial plans. In this important sense, they are institution-specific.... They are intended to provide a means of assessing the match between institutional purpose and performance." This work is ongoing.

Research Overheads / Infrastructure Envelope

Since 1987, the Province of Ontario has provided funds to universities through a special funding envelope intended to help support the indirect costs of the research funded through the three federal granting councils. The current value of the Research Overheads/Infrastructure (RO/I) Envelope is \$27.5 million, representing 1.8% of the \$1.549 billion in university operating grants provided by the province for 1997-98. The envelope is distributed among the universities on the basis of their average proportionate share of pre-adjudicated awards received from the three granting councils over a three-year period. The RO/I Envelope is the only funding envelope that allocates operating funds to the universities on the basis of measures of quality, specifically, their performance in winning competitively awarded research grants.

Ontario Centres of Excellence Program

The Ontario Centres of Excellence Program is an important part of the Ontario government's support of research that focuses on excellence in basic and applied research and on university partnerships with industry. The Centres program, administered by the Ontario Ministry of Economic Development, Trade and Technology (MEDTT), was established in 1987, when seven centres were selected for funding following an open competition under which proposals from 28 university groups were evaluated by an internal panel of experts.

The centres were established to strengthen the research link between industry and universities and, therein, to help the Ontario economy become internationally competitive through advancing scientific knowledge and technical innovation. The centres are dedicated to long-term fundamental research and shorter-term applied research that combines economic and intellectual strategies.

A commitment of funding for the Centres program was made for an initial five-year period (1987-88 through 1991-92). The program was renewed for another five years (1992-93 through 1996-97), during which time a thorough review of the program was conducted. Each centre was reviewed by an independent review panel according to guidelines provided by MEDTT. Following the review, it was announced that the program would be continued for an additional five years (1997-98 through 2001-02), with modifications that resulted in four versus seven centres. The restructuring is intended to reflect the convergence of technologies and provide for a more streamlined approach. The Ontario government will contribute \$151.5 million over five years to the centres.

Ontario Research and Development Challenge Fund

In its May 6, 1997 budget, the Government of Ontario announced the establishment of an R&D Challenge Fund. The provincial government will provide \$50 million per year over 10 years to universities, research-oriented health care facilities, and other research organizations, to promote business-university partnerships and research excellence.

The Challenge Fund will support projects in which the private sector funds at least one third of project costs. Universities will also be expected to contribute their own resources and raise funds through other sources such as the federal granting councils and the Canada Foundation for Innovation (CFI). The Challenge Fund will help ensure that Ontario's 17 universities can compete effectively for CFI funding.

Funds will be awarded on a competitive basis, according to a proposal's contribution to research excellence and economic growth, which will be decided through a peer-review process. All disciplines will be eligible for support, but it is expected that the fund will primarily focus on the fields of natural science and engineering, mathematics, health sciences and environmental sciences.

Canada Foundation for Innovation

The Canada Foundation for Innovation (CFI), the creation of which was proposed in the federal government's 1997 budget, will represent a new way of strengthening education and research. CFI will be an independent, not-for-profit corporation that will operate at arm's length from the federal government. With an up-front investment by the federal government of approximately \$800 million, the proposed foundation will be supported by a small secretariat, and will draw on expertise and peer-review assessment procedures of the federal granting councils.

CFI will accept applications from universities and colleges engaged in research, research hospitals and associated not-for-profit research institutes and organizations. It will complement, not duplicate, the role of the three federal granting councils, the Networks of Centres of Excellence and the National Research Council. The funds provided to the foundation will be targeted toward key needs in the areas of health, the environment, science and engineering.

UNIVERSITIES AND TECHNOLOGY TRANSFER

(William A. Bridger, Vice-President, Research, University of Western Ontario, London, Canada)

Over the last 10 to 15 years, Ontario universities have taken on greatly expanded roles in activities that are often collectively referred to as technology transfer. These activities fall into two categories: Industry Pull and Technology Push.

Industry Pull

This category describes situations wherein universities participate in partnerships with industry, solving problems that are defined by the needs of industry. It is frequently the case that universities, through the particular technical expertise of members of faculty and/or the availability of highly specialized instrumentation, have resources that will assist industry in solving specific problems or provide basic knowledge in an area of interest. These circumstances give rise to at least three kinds of formal agreements that permit universities to enter into productive partnerships to address these needs of industry:

- **Contract Research:** When the framework of the required research is focused on a specific topic or problem, normally of a proprietary nature, industry will enter into a contract with the university. Such contracts, typically with defined time lines and schedules of deliverables, facilitate the application of the resources of the university to the particular needs of industry, thereby avoiding the need for the industrial partner to develop in-house expertise and specialized facilities. Provided that the contract permits publication of results following a reasonable period of confidentiality, it is possible for contract research to be carried out with the assistance of graduate students who, in turn, gain by their experience in working on a problem of short-term economic relevance. Given the nature of the work and the relationship, universities must require the contracting industrial partner to cover not only the direct costs of the research, but also a component related to the indirect costs or "overhead." Indirect costs include such items as the use of the time of the faculty member and his/her research space and equipment, library and other support facilities, administrative costs, utilities, etc. Systematic estimates indicate that indirect costs average approximately 50 cents per dollar, justifying the application of overhead charges that are typically in the 40% to 50% range relative to direct costs.
- **Grants:** Frequently, a partner from the private sector (or from government) will have an interest in the general line of research that is being undertaken by an investigator or team of researchers and will provide grants to support this research. The normal defining

characteristics of a grant, as opposed to a contract, are its pre-competitive nature, the absence of strictly defined deliverables and time lines, and the absence of provision for confidentiality or claim of ownership or proprietary use of resultant intellectual property. These characteristics provide support for the research team to define and pursue their own lines of inquiry within the general framework of the grant and are, therefore, subject to substantially reduced recovery of indirect costs. (Some universities do not charge any overhead for industrial grants.)

- **Research Consortia and Networks:** These complex and longer-term structures for partnership between industry and universities normally arise when companies operating within a technology-based industrial sector share a need for basic or applied research that is of mutual interest and of a pre-proprietary nature. Research consortia and networks typically involve groups of investigators at several universities and several industrial partners. This concept is the basis for the successful Ontario Centres of Excellence Program, which in turn inspired the federally supported Network of Centres of Excellence Program. The latter program has now been given a permanent existence as the result of the federal government's February 1977 budget provisions. There are examples of research consortia outside of these government-sponsored and government-funded network programs that follow the same principle. Perhaps the largest and most successful of these programs is TRILabs, a consortium of telecommunications companies working in partnerships with several prairie universities to solve problems of mutual interest. The universities (mainly their Faculties of Engineering) provide partly seconded faculty members and graduate students who work together on problems identified by the consortium. This has proven to be a particularly effective vehicle for training of doctoral students, with a majority of those participating gaining continued employment after graduation.

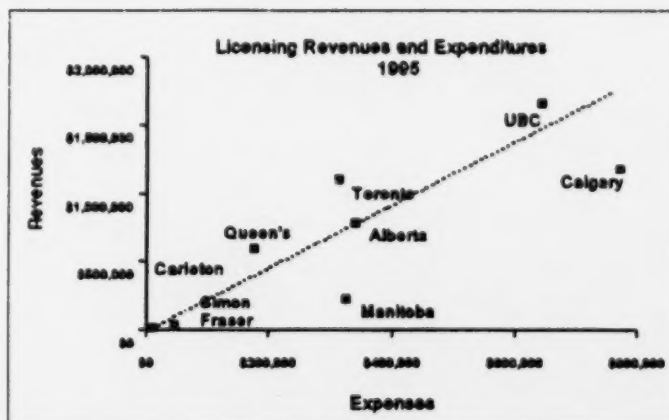
Technology Push

Most major technological advances of the second half of this century have their origins in university research. These include, but are not limited to, such advances as those represented by the new biotechnology industries, by astonishing developments in telecommunications, and by the introduction of new materials for manufacturing. Analysis of the evolution of new economic advances based on basic research in universities has clearly shown that, in most cases, the seminal research was not undertaken because of an objective of the investigator to ask and answer new questions. History has shown that university research, whether so designed or not, may result in intellectual property that has substantial potential for commercialization.

Particularly in the last 10 years, universities in Canada have become increasingly active in ensuring that commercial opportunities arising from their research are captured. Most universities have rewritten their policies governing intellectual property. While there is great individual variation, virtually all research-intensive universities in North America have policies that recognize the role of the university and the public purse in the development of the intellectual property by granting the institution the first right to commercialize. Ownership of intellectual property varies greatly among major Canadian universities. The University of British Columbia, McMaster and Guelph, for example, have policies that have ownership vested in the institution, and the universities of Alberta and Western Ontario are currently developing policies that would have a similar provision. The universities of Waterloo, Toronto and Queen's have policies that have ownership vested in the faculty member. Several universities, including Toronto, Queen's, Guelph and Calgary, have created separate foundations or corporations to handle the commercialization of technologies. Among the major research-intensive universities, Waterloo has an unusual policy that allows and encourages the private commercialization of intellectual property by the faculty without requiring financial recognition of the contribution of the institution to its development.

Typically, new discoveries are reported to the university officer charged with the responsibility for the commercial developments prior to their publication. The university will then determine whether it will exercise its option to commercialize the intellectual property, basing its decision on such factors as uniqueness, market niche and market capacity. When the university exercises its option, it will then provide professional assistance, working in partnership with the investigator, to ensure adequate protection (normally by means of patent or copyright) for the intellectual property before its disclosure by publication or other means of public communication. Universities' intellectual-property policies typically provide for sharing of the net proceeds of the commercialization following licence of the technology or spin-off company formation.

It must be understood that the mere issuance of a patent is of little value unless there is subsequent commercial use of the patented innovation. For this reason, universities will measure licensing income, rather than a number of patents filed or awarded, as a measure of contribution in this area of technology transfer. The process of protections of intellectual property is expensive, with its accompanying due



diligence, market analysis and legal fees. Universities must, therefore, be prepared to make significant investments in this area before they can expect a return. Analysis of data provided by the Association of University Technology Managers (AUTM) shows that there is approximately a 2:1 return on universities made in this area. Data for some reporting Canadian universities are shown in the graph on the previous page.

In today's global marketplace, licences for the use of patented technologies may be issued to companies anywhere in the world. However, universities must recognize that, to optimize the return to the local economy, it is desirable to license their technologies where possible to companies that are close to home, thus contributing to jobs and economic development in the region that in turn supports the university.

Instead of issuing licences for the use of patented technologies, the inventor and the university may act to form a spin-off company. If successful, such a company will provide local jobs and economic development. While there are many outstanding examples of university-based spin-off companies of varying sizes in Canada -- scores of biotechnology, engineering and telecommunications companies have evolved from Canadian university research -- activity has not matched that of the United States (see sidebar)

States compete to recruit top scientists

...In their search for high-tech, high-paying jobs, state governments today are digging deeper into their coffers than ever before. Although many legislatures have long dreamed of building a Silicon Valley in their backyards, their efforts have often been hampered by tight budgets and more immediate economic development concerns, such as the need for new roads. Now, however, with the economy in its sixth year of expansion, many states have the resources to throw bigger pots of money and bigger promises of support at would-be rain makers [highly sought-after university faculty recruits]. The gamble is that once the researchers are in the state, they will become a powerful lure to high-tech startups that want to be near ground-breaking laboratories. State officials also hope that researchers, with the help of seed money from state-supported venture-capital funds, will form their own companies to capitalize on their discoveries.

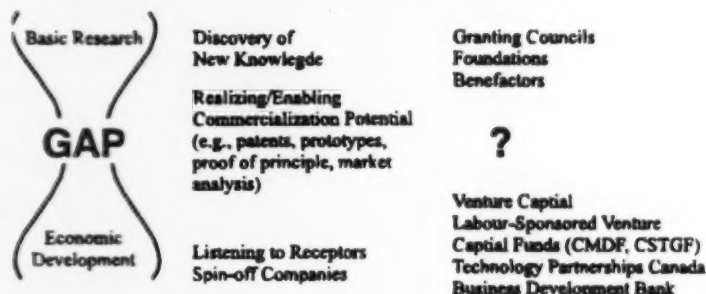
Perhaps nowhere is the competition for scientists more fierce than in the South... Georgia's Research Alliance has spent more than \$160-million recruiting 22 scientists in the hope that their ideas will spawn thriving businesses in biotechnology and advanced telecommunications.

— Greg Jaffe, *The Wall Street Journal*
Reprinted in *The Globe and Mail*, April 23/97

Resources Required for Effective Technology Transfer

Obviously, effective technology transfer requires outstanding researchers and modern facilities and equipment. It is therefore essential that our universities have the resources to allow them to attract the best young faculty members at a time when virtually all universities are trying to accomplish the same thing. While the issue of competitive salaries is important, it is probably overshadowed by the provision of an environment that will provide researchers with the time and research infrastructure (laboratories, equipment, graduate students, etc.) to carry out their work as effectively and creatively as possible.

The GAP in Technology Transfer



Although resources available for the support of basic research are diminishing, we must anticipate that outstanding researchers will have the capacity to raise funds required for operating their laboratories from these or other sources. (For example, the budgets of three federal granting councils, MRC, NSERC and SSHRC, were reduced by 13%, 17.5% and 17.5% respectively in 1996-97, with further substantial cuts mandated for 1997-98.)

Canada has now developed ample sources of venture capital to support promising companies that spin off from university research, and to keep them in Canada. Most notable among these are the Labour-Sponsored Venture Capital Funds (Canadian Medical Discoveries Fund, Canadian Science and Technology Growth Fund, and others) that have substantial resources available for this purpose. As the cartoon above indicates, the current gap in the required resources lies between the discovery of new knowledge and its ultimate application for economic development. The unsupported costs are those that are required to take an initial discovery or invention having commercializable potential, through to a spin-off company or commercializable product that has sufficient maturity to be of interest to venture capitalists. Examples of these costs include patenting and other legal costs to protect the intellectual property, production of prototypes, proof of principle, due diligence and market analysis. It is essential that universities develop the necessary resources to bridge this gap if technology transfer is to be fully effective.

A Time of Change

In a little over a decade, huge changes have taken place in Canada's universities in the closely related industries of technology transfer and partnership with industry. Not too many years ago, many university researchers viewed industry money as somehow tainted and felt it inappropriate to develop funding for their research from sources other than government and volunteer-supported granting agencies. At the same time, most university researchers rarely paused to consider the possible commercialization potential of the results of their work, and they proceeded to place their intellectual property in the public domain with protecting it.

Times have changed dramatically, and partnership with industry has become a highly respected activity within our universities. Driven both by the scarcity of traditional sources of funds and an awakening of entrepreneurial spirit, many university researchers are now working with industry through industrial grants, contracts, networks and consortia. Similarly, our researchers are acting upon opportunities for licensing of their discoveries and for spin-off company formation. For their part, our universities have responded by investing substantial sums, during times of unprecedented financial restraint, in professionally staffed industry liaison offices that facilitate the formation of spin-off companies by the establishment of technology development centres or "incubation" facilities in their buildings or in their associated research parks. If the current place of change is encouraged to continue by continued strategic investment in its fine universities, Ontario is destined to emerge as a front-runner in the new knowledge-based economy of the 21st century.

Institutional Research Performance Indicators

- | | | |
|----|---|---|
| 1. | "Research Intensity": | $\frac{\text{Sponsored research revenue}}{\text{Total provincial grant}}$ |
| 2. | Granting council success rates: | $\frac{\text{Number of grants (NSERC, SSHRC, MRC)}}{\text{Number of eligible faculty}}$ |
| 3. | Graduate student research: | $\frac{\text{Number of graduate students (thesis-based)}}{\text{Total FTE faculty}}$ |
| 4. | Awards and distinctions: | Membership on national or international
granting agencies or equivalent,
scholarly associations (e.g., RSC) |
| 5. | Industrial research: | $\frac{\text{Total industry-sponsored research revenue}}{\text{Total research revenue}}$ |
| 6. | Technology transfer: | $\frac{\text{Total licensing revenue}}{\text{Total sponsored research revenue}}$ |
| 7. | Publications, performances,
presentations: | As normally listed in institutional reports; lists of
publications should exclude abstracts and other non-
refereed publications. |

Quantitative Indicators															
1	Refereed journal publications or equivalent	✓✓		✓✓		✓✓		✓✓		✓✓		✓✓		✓✓	
2	Book publication — Authorship		✓✓	✓					✓✓		✓✓		✓✓		✓✓
3	Book publication — Editing		✓	✓											
4	[Research Grants + Contracts] + Operating Budget	✓✓		✓				✓✓		✓✓		✓✓		✓✓	
5	Per cent faculty members funded by granting councils		✓✓	✓✓		✓✓		✓✓		✓✓		✓✓		✓✓	
6	Participation on National Review Committees, etc.	✓		✓		✓		✓		✓		✓		✓	
7	Invited presentations at national and international meetings	✓		✓		✓		✓		✓		✓		✓	
8	Industrial Contracts							✓							
9	Patents and Royalties held														✓
10	Technical reports							✓							
11	Case books, treatises, edited articles and case comments							✓✓							
12a	Exhibitions (solo or group) (artists)					✓✓									
12b	Performances (solo) or grand performances of composition (musicians)					✓✓									
12c	Theatrical, film, TV performances (drama)					✓✓									
13	Extramural salary awards									✓✓		✓✓			
Non-Quantitative Indicators or Anecdotal Supporting Information															
14	Impact of research on business or government policy	✓				✓									
15	Impact of research on educational policy, practice or curriculum							✓					✓		
16	Expert consultations					✓				✓					
17	National and international research collaborations							✓							
18	Impact of clinical research on patient care									✓✓		✓✓		✓✓	
19	Contribution to service facilities, community organizations												✓		
20	Reprint or translation of published work		✓										✓		
Universal Indicators															
21	Career paths of graduate students and PhD's	Universal indicator — applies to all													
22	Awards or recognition	Universal indicator — applies to all													

For each Faculty (or division thereof) the two most appropriate research indicators are indicated by double check marks (✓✓). Two to four other appropriate indicators are shown by single checks (✓). Two indicators (nos. 21 and 22) are thought to be universally applicable.

Note: 1. Numbers of publications in peer-reviewed journals. Does not normally include Abstracts that may be subsequently published in journal format. Although citation data (Institute for Scientific Information) can be required to complement, total publications is indication of research productivity in a Faculty or Department. Care should be taken to allow for long-term longitudinal studies that take many years for completion.

Note: 2. Some disciplines, particularly in the humanities, are not heavily committed to journal publication. Authorship of books is a particularly strong indicator in these cases. While this criterion calls only for an overall total of books authored, it may be useful and instructive to break these down into creative work (e.g., novels) and critical/analytical studies.

Note: 3. Total number of books edited, where editing is extensive and where a major introduction is included.

Note: 4. "Research Intensity Index" important to make comparisons to similar disciplines within university or to equivalent unit in other universities.

Note: 5. Fraction of faculty who are funded may be better indicator than \$4 for disciplines that do not require substantial levels of funding. Comparisons to like faculties at other institutions may be instructive.

Note: 6. Includes membership on grant review committees for federal granting councils, foundations, etc. Also includes membership on editorial boards and other responsibilities where expertise in research is considered to be the prime qualification for membership.

Note: 7. Emphasis here is on "invited" invitations to speak (particularly at expense of organizers) seen as important recognition of research contributions and reputation.

Note: 8. Licensing of patents (i.e. actual use) seen as much more important indicator than simple number of patents issued.

Note: 10. Technical reports to industry are seen as important indicators in the Faculty of Engineering.

Note: 12 a,b,c. Criteria developed for Fine Arts disciplines.

Note: 13. Extramural salary awards refers to number of AHFMR/MRC Scholars/Scientists, or equivalent.

Note: 21. In principle, this could be one of the most useful indicators of the reputation of a department. Comparisons are difficult, however, because of obvious differences in the career opportunities in various disciplines, and also by the difficulty in obtaining complete and objective data.

Note: 22. Includes major awards by peers, election to Fellowship in Royal Society of Canada or other discipline-specific recognition for research contributions.

CONCLUSION

The foregoing has provided a description of the processes in place for assessing university research in Ontario. The provincial government, the federal government and the universities themselves have an interest in ensuring that the research conducted within the universities and related institutions is of high quality, and that resources are directed toward ensuring excellent, world-class research that will promote the technological, scientific, medical, economic and social development of the province and country.